

Claims

1. An agent for prevention and/or treatment of asthma, which comprises, as an active ingredient, a substance capable of suppressing the function involved in signal transduction of a protein having the amino acid sequence represented by SEQ ID NO: 11.

2. An agent for prevention and/or treatment of asthma, which comprises one of the following 1) to 4) as an active ingredient:

1) an oligonucleotide having a sequence complementary to that of oligonucleotide comprising continuous 5 to 60 nucleotides selected from the nucleotide sequence represented by SEQ ID NO: 12 or a derivative of said oligonucleotide,

2) an oligonucleotide having a sequence complementary to that of oligonucleotide comprising continuous 5 to 60 nucleotides selected from the nucleotide sequence represented by SEQ ID NO: 14 or a derivative of said oligonucleotide,

3) an oligonucleotide having a sequence complementary to that of oligonucleotide comprising continuous 5 to 60 nucleotides selected from the nucleotide sequence represented by SEQ ID NO: 18 or a derivative of said oligonucleotide, and

4) an oligonucleotide comprising 5 to 60 nucleotides which hybridizes under stringent conditions with DNA having the nucleotide sequence represented by one member selected from

SEQ ID NOs: 12, 14 and 18 and which is capable of suppressing the function involved in signal transduction of protein having the amino acid sequence represented by SEQ ID NO: 11 or a derivative of said oligonucleotide.

3. An agent for prevention and/or treatment of asthma, which comprises one of the following 1) to 4) as an active ingredient:

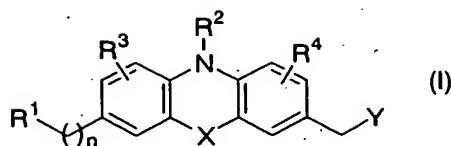
1) an antibody which recognizes a protein having the amino acid sequence represented by SEQ ID NO: 11,

2) an antibody which recognizes a protein having the amino acid sequence represented by SEQ ID NO: 13,

3) an antibody which recognizes a protein having the amino acid sequence represented by SEQ ID NO: 17, and

4) an antibody, which recognizes a protein having the amino acid sequence in which one or more amino acid(s) is/are deleted, substituted or added in the amino acid sequence represented by one member selected from SEQ ID NOs: 11, 13 and 17 and which has the function involved in signal transduction of a protein having the amino acid sequence represented by SEQ ID NO: 11.

4. An agent for prevention and/or treatment of asthma, which comprises a nitrogen-containing tricyclic compound represented by the formula (I) or a quaternary ammonium salt thereof, or a pharmaceutically acceptable salt thereof;



[wherein R^1 represents a substituted or unsubstituted heterocyclic group, $-NR^5R^6$ (wherein R^5 and R^6 are the same or different and each represents hydrogen, substituted or unsubstituted lower alkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted lower alkenyl, substituted or unsubstituted lower alkynyl, substituted or unsubstituted aralkyl or substituted or unsubstituted heterocyclic alkyl, or R^5 and R^6 are combined together with the adjacent nitrogen atom to form a substituted or unsubstituted heterocyclic group), $-OR^7$ (wherein R^7 represents hydrogen, substituted or unsubstituted lower alkyl, substituted or unsubstituted lower alkanoyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted lower alkenyl, substituted or unsubstituted lower alkynyl, substituted or unsubstituted aryl, substituted or unsubstituted aralkyl or substituted or unsubstituted heterocyclic alkyl), $-SR^{7a}$ (wherein R^{7a} has the same meaning as the above R^7), $-CONR^{5a}R^{6a}$ (wherein R^{5a} and R^{6a} have the same meanings as the above R^5 and R^6 , respectively), $-CO_2R^{7b}$ (wherein R^{7b} has the same meaning as the above R^7), $-N^+R^{5b}R^{6b}R^8$ (wherein R^{5b} and R^{6b} have the same meanings as the above R^5 and R^6 , respectively, and R^8 represents lower alkyl, lower alkenyl or aralkyl), formyl, carboxy or cyano;

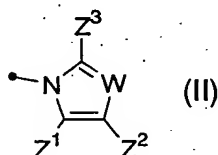
R^2 represents hydrogen, substituted or unsubstituted lower alkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted lower alkenyl, substituted or unsubstituted lower alkynyl, substituted or unsubstituted aralkyl or substituted or unsubstituted heterocyclic alkyl;

R^3 and R^4 are the same or different and each represents hydrogen, lower alkyl or halogen;

n represents 0 or 1;

X represents $-(CH_2)_2-$ or $-CH=CH-$; and

Y represents the formula (II);



(wherein W represents CH or a nitrogen atom;

Z^1 and Z^2 are the same or different and each represents hydrogen, substituted or unsubstituted lower alkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted lower alkenyl, substituted or unsubstituted lower alkynyl, substituted or unsubstituted aryl, substituted or unsubstituted aralkyl or substituted or unsubstituted heterocyclic alkyl, or Z^1 and Z^2 are combined together with two carbon atoms being adjacent to each of them to form a substituted or unsubstituted aromatic ring or substituted or unsubstituted heterocycle; and

Z^3 represents hydrogen, substituted or unsubstituted lower alkyl,

substituted or unsubstituted cycloalkyl, substituted or unsubstituted lower alkenyl, substituted or unsubstituted lower alkynyl, substituted or unsubstituted aryl, a substituted or unsubstituted heterocyclic group, substituted or unsubstituted aralkyl or substituted or unsubstituted heterocyclic alkyl)] as an active ingredient.

5. The agent for prevention and/or treatment of asthma according to claim 4, wherein R^1 is $-NR^5R^6$ and R^5 and R^6 are combined together with the adjacent nitrogen atom to form a substituted or unsubstituted heterocyclic group.

6. The agent for prevention and/or treatment of asthma according to claim 4 or 5, wherein R^2 is hydrogen.

7. The agent for prevention and/or treatment of asthma according to any one of claims 4 to 6, wherein R^3 and R^4 are hydrogen.

8. The agent for prevention and/or treatment of asthma according to any one of claims 4 to 7, wherein Z^1 and Z^2 are combined together with two carbon atoms being adjacent to each of them to form substituted or unsubstituted heterocycle.

9. A method for prevention and/or treatment of asthma, which comprises administering an effective amount of the nitrogen-containing tricyclic compound or the quaternary ammonium salt thereof, or the pharmaceutically acceptable salt thereof described in any one of claims 4 to 8.

10. Use of the nitrogen-containing tricyclic compound

or the quaternary ammonium salt thereof, or the pharmaceutically acceptable salt thereof described in any one of claims 4 to 8 for the manufacture of an agent for prevention and/or treatment of asthma.

11. A method for prevention and/or treatment of asthma, which comprises administering a therapeutically effective amount of a substance capable of suppressing the function involved in signal transduction of a protein comprising the amino acid sequence represented by SEQ ID NO: 11.

12. A method for prevention and/or treatment of asthma, which comprises administering a therapeutically effective amount of an oligonucleotide or a derivative of said oligonucleotide which is any one of 1) to 4) described in claim 2.

13. A method for prevention and/or treatment of asthma, which comprises administering a therapeutically effective amount of an antibody which is any one of 1) to 4) described in claim 3.

14. Use of a substance capable of suppressing the function involved in signal transduction of a protein having the amino acid sequence represented by SEQ ID NO: 11 for the manufacture of an agent for prevention and/or treatment of asthma.

15. Use of an oligonucleotide or a derivative of said oligonucleotide which is any one of 1) to 4) described in claim 2 for the manufacture of an agent for prevention and/or treatment

of asthma.

16. Use of an antibody which is any one of 1) to 4) described in claim 3 for the manufacture of an agent for prevention and/or treatment of asthma.